

SCIENCE.

FRIDAY, DECEMBER 11, 1885.

COMMENT AND CRITICISM.

THE STATEMENT that one of the chief applications of composite photography will be in the direction of producing more reliable portraits of representative men by combining the testimonials of individual artists, will probably be accepted by all who have followed the short but interesting career of this new invention. The suggestion that, by combining the individual conceptions of several artists, one would obtain a more reliable portrait than any of the components, was near at hand. The first such application was made by Mr. Galton himself. He made a composite of six medallion heads of Alexander the Great, and naturally claimed for the composite the combined authority of all the artists; for it is evident, that, while each artist will very likely express the general features of his subject, some peculiar idiosyncrasies of his own are apt to creep in. The composite sifts out all these common traits, and presents them strong and clear, while it reduces each artist's peculiarity to a scarcely perceptible shadow.

In this way we have recently come into possession of a new Shakspeare, for which we have to thank Mr. Walter Rogers Furness. In the case of Shakspeare the diversity amongst the several originals is strikingly evident, and thus a composite was needed to give a characteristic, individual, natural face. This suggested to Mr. W. C. Taylor the application of the same process to Washington's portraits. He has grouped the several portraits into three groups, owing to the differences of position of the portraits, and the accuracy of the work is well shown by the fact that the agreement amongst the resulting three composites is very close, while the originals show every shade of individual differences. These portraits were first published in the *Journal of the Franklin Institute*, and are given on a new and enlarged plate in this number. The lower right-hand composite has seemed to many the happiest result, and seems likely to serve as the model for future portraits of Washington.

No. 149. — 1885.

PRESIDENT CLEVELAND, in his annual message to congress, referred to several matters of interest to scientific men. Of the coast survey he says: "It was many years ago sanctioned, apparently for a purpose regarded as temporary, and related to a survey of our coast. Having gained a place in the appropriations made by congress, it has gradually taken to itself powers and objects not contemplated in its creation, and extended its operations until it sadly needs legislative attention. So far as a further survey of our coast is concerned, there seems to be a propriety in transferring that work to the navy department. The other duties now in charge of this establishment, if they cannot be profitably attached to some existing department or other bureau, should be prosecuted under a law exactly defining their scope and purpose, and with a careful discrimination between the scientific inquiries which may properly be assumed by the government and those which should be undertaken by state authority or by individual enterprise. It is hoped that the report of the congressional committee heretofore appointed to investigate this and other like matters will aid in the accomplishment of proper legislation on this subject." The recommendation to break up the present organization will certainly be received with regret by the well-wishers of the survey. For the signal service the president has suggestions which will be received by many of our readers with more favor. He says: "In view of the fact referred to by the secretary of war, that the work of this service ordinarily is of a scientific nature, and the further fact that it is assuming larger proportions constantly, and becoming more and more unsuited to the fixed rules which must govern the army, I am inclined to agree with him in the opinion that it should be separately established." Of this service, also, the president remarks that the scope of its operations should be definitely prescribed. He seems to fear that the scientific work carried on by the government may get beyond bounds, the nature of which, however, he does not define. At the close of the message the attention of congress is called once more to the need of providing quarters for the library of the capitol, the books of which are now kept in piles.

IT SEEMS PROBABLE that Pasteur will be able by means of observations on human beings to determine the practical value of his method of inoculation for the prevention of hydrophobia. On Dec. 4 six children in Newark were bitten by a dog which was probably rabid. It has been decided to send four of these children to Paris to be treated by Pasteur according to his method. Probably about sixteen or seventeen days will elapse between the reception of the bites and the beginning of the treatment. Regarded as an experiment, the value of the result of this treatment is increased by the fact that two of the children will remain at home, and will probably not be subjected to the treatment. Unfortunately the dog was killed, so that positive proof of its being rabid does not exist.

It is not difficult to find much to criticise in Pasteur's experiments on hydrophobia so far as they have been reported. It should, however, be remembered that these experiments have not yet been published in detail, and it is not probable that many points of criticism which readily suggest themselves have escaped so acute and accurate an observer as Pasteur. In fact, the main support of Pasteur's views lies in his established reputation as a cautious and far-seeing experimenter. As has been suggested in previous articles upon this subject in recent numbers of *Science*, it certainly seems a weak point that no micro-organism or characteristic lesion has been discovered by which it can be positively demonstrated that the disease which Pasteur produces in rabbits is hydrophobia. It has even been suggested that the disease of the rabbits is possibly only septicaemia. It will require a large number of observations on human beings before it can be proven that Pasteur's inoculations really prevent the development of hydrophobia. It is to be remembered that not a few of the dogs popularly supposed to be mad, and which are killed for this reason, are not affected with rabies. It is also abundantly established that a considerable proportion of those who are bitten by mad dogs never develop hydrophobia. Of those who are subjected to Pasteur's treatment, the wound has in most cases been already cauterized or excised, and this local treatment may account for the favorable result in some instances. But, notwithstanding all possible objections, there is still sufficient ground for confidence in Pasteur's conclusions to make it a matter of congratulation that the value of his treatment is to be so rapidly

and so fully tested by its application to human beings. It has been recently announced that in one case, in which Pasteur began his treatment thirty-six days after the reception of the bites, the patient has died of hydrophobia. Pasteur attributes the unfavorable result to the long interval which had elapsed between the reception of the bites and the beginning of the treatment.

AT THE PRESENT TIME, when so much is said and written of 'mad dogs,' it may be well to recognize that, as the *Lancet* says, fear or nervous apprehension can induce a fatal disease having nearly, if not all, the characters of hydrophobia. It is not necessarily true that hydrophobia is always brought on by the mental anxiety that a dog-bite not infrequently occasions. Hydrophobia is a nervous disease, but it has probably a material cause, a poison, which is most likely a 'germ' or micro-organism. It is a curious fact that birds, even when inoculated with the poison of rabies, do not suffer from the disease; and some individuals appear to enjoy, with birds, the same kind of immunity. The *Lancet* further points out that whether it is those persons who are not given to fear or nervous apprehension who always escape hydrophobia, even though bitten by a rabid dog, we are not in a position to state. But nothing can be more detrimental to a bitten individual than to brood over his misfortune, or make himself miserable by learning all the symptoms of hydrophobia.

SINCE THE RESEARCHES of Pflüger have shown that the oxidation and reduction processes which are the basis of life take place, not in the blood, but in the tissues, attempts have been made to localize these processes. But up to the present very little progress has been made in this line of study. Prof. P. Ehrlich of Berlin has employed a novel method of studying this question, which consists in injecting colored substances which by reduction become colorless, and after death observing which tissues are colored, and which colorless, and, further, determining which of the colorless tissues become colored by oxidation outside of the body. Those tissues which after death are at first colorless, but which become colored by treatment with an oxidizing agent, were, of course, the seat of reduction within the body. The two colored substances used in most of the experiments were alizarin-blue and indophenol.

The latter is more easily reduced than the former, and when it was used a larger number of tissues were found colorless after death. Those tissues which were colorless when alizarin-blue was used were the seat of the most active reduction during life. The author does not profess to have done more than lay the groundwork for future investigation. The results thus far reached do not enable him to draw any very important conclusions, though his discussion is interesting and highly suggestive.

A NATIONAL UNIVERSITY.

SECRETARY LAMAR recommends in his annual report that a 'national university' be established in Washington. He says that "this national institution, which Washington, Adams, Jefferson, and Madison thought so necessary, has never been established; and in these later years the idea of a national university constitutes no part of the plans of statesmen, and seems to have been lost sight of by the people." This statement is not strictly correct, for it seems that in 1869 Dr. John W. Hoyt of Wisconsin brought before the National teachers' association, meeting that year at Trenton, N.J., a resolution, which was adopted, to the effect, that, in the opinion of that association, "a great American university is a leading want of American education;" and a committee was appointed to mature plans for such a university. This proposition was considered at the meetings of the association in 1870 and 1871, but there is no evidence that the committee ever did any active work.

Notwithstanding this inaction of the project, some action was taken by congress in the spring of 1872, looking to the establishment of such a university, when two bills were brought into the senate. One of these was drawn by Dr. Hoyt, who, although chairman of the committee of the national association, had never been able to get that committee together, and it was therefore essentially a bill presented by a private citizen. Neither bill was supported by anybody in any way; and the senators who introduced them did not imagine for a moment that any legislation would grow out of them.

Secretary Lamar calls attention to the scientific bureaus which "have grown up, one by one, under the government, with observatories, laboratories, museums, and libraries, until the whole range of physical science is represented by national institutions established by the government for the pur-

pose of prosecuting researches, embracing astronomy, meteorology, geography of land and sea, geology, chemistry, statistics, mechanical inventions, etc.," and expresses an opinion, that, if these bureaus "could be combined as integral parts of one scientific institution, such an institution would be of greater proportions and more comprehensive than any other in the world;" and that, "should a university be erected thereon with a superstructure commensurate with the foundation, it would be without a rival in any country." This is a picture of a crowning university, richer, better, and more comprehensive than any existing institution, which may to some be fascinating.

By all these would-be benefactors of American education, many of the difficulties in the way of establishing a national university have been overlooked. In August, 1873, President Eliot of Harvard made a report to the National educational association on the then talked of national university. Although in his report we find little of "democracies having been the cradles of pure thought and art," or of a burning aspiration on the part of the American people for "a higher education, — higher than the common school or academy or college can furnish," — we do find much of the cool common sense of that well-known leader of education.

We can hardly hope as yet that civil service reform is fully established in the United States. There is, therefore, a fatal defect in any congressional bill to establish a university, so long as the principles of appointment to United States offices, and the tenure of those offices, remain what they now are. A teacher should hold office through good behavior and competency, and it is only upon these conditions that competent professors can be secured for our colleges and universities. Permanence of tenure is necessary to make the position of a teacher one of dignity and independence; and young men of vigor will not enter a profession which offers no money prizes, unless they are induced by stability and peacefulness, and by the social consideration which attaches to it.

The government of a national university would necessarily be in the hands of some board of officers, and the constitution of such a board would lead to many difficulties. If the principle of local representation were to be applied, one would infer that the interests of Maine and Oregon, Minnesota and Florida, must necessarily be different, whereas philology, history, philosophy, science, and mathematics are the same in Massachusetts and Cali-

fornia. The professorships might as well be divided around among the states, as the places in the board of regents. The influence of sectional feeling could but be felt, and would certainly be injurious.

The demand by the American people for a higher education, referred to by Secretary Lamar, evidently means free education. The gift of such an education would rest in the hands of the members of congress, and would only place so much injurious patronage at their disposal. Our leading universities are already so well supplied with scholarships, and there are so many benevolent people standing ready to give assistance, that no deserving American boy need despair, from want of funds, of obtaining a liberal education.

Another point to be considered, before congress attempts to establish a university, is whether it would not be acting on un-American principles. During the war the country became accustomed to seeing the powers of the government exerted energetically for destructive purposes, and since the war there has been success in turning this power to the aid of the arts of peace, and markedly in the building of railroads. Had we not better leave the paternal government to Europe, and follow the example of our ancestors, who well understood, that, to make the people free and self-reliant, it is necessary to let them take care of themselves, even if they do not take quite as good care of themselves as some superior power might? We have already several good universities. Let us turn our energies to their development, and to the aid of those promised in the newer parts of the country.

THE DECAY OF THE OBELISK.

AT the time the obelisk was placed in its present position in Central park, considerable discussion was aroused as to the ability of the stone to withstand the rigors of our climate. Upon examination the surface of the obelisk appeared so fresh, that authorities consulted at the time seemed to think that we need give ourselves no uneasiness as to the durability of the stone, and concluded that any action of climatic agencies would proceed with extreme slowness. Now, within less than five years, the commissioners of public parks in New York, acting under advice of Dr. Doremus, have found it necessary to cover the obelisk with a preparation of paraffine.

My attention during the past summer having been called to certain forms of weathering, due,

as I supposed, to the expansion and contraction of the surface from excessive daily changes of temperature, I desired to examine the obelisk. Through the courtesy of the park commissioners, I was invited to inspect it at the time the scaffolding was first erected for the purpose of making a preliminary examination of the shaft from base to apex. While expecting to find some crumbling, I was quite unprepared for the rapid disintegration observed on all sides.

Comments upon the recent condition of the stone have led to some misconception as to the cause of the weathering. It has frequently been spoken of as the result of the action of the atmosphere, causing chemical decomposition of individual minerals in the rock. This is a mistake. The weathering, in my opinion, is almost wholly a process of disintegration, and not of decomposition.

At the time of the preliminary examination, the surface of the granite was found to be more or less in a state of disintegration; fragments being easily detached with any sharp-pointed instrument, while on the scaffolding pieces several inches in length were removed by means of the small blade of a penknife. One piece which I collected, taken from the west side of the obelisk, measured ten inches in length, and over one-half inch in thickness. A thin tabular specimen from the south face was four inches long by three wide. Since then, I understand, much larger pieces have been removed. An examination of both the firmer parts of the obelisk and the detached pieces present an equally unaltered condition of the constituent minerals. Indeed, the most marked feature of the rock is its fresh appearance.

A thin section of the rock, prepared for examination under the microscope, presents identical characters with those given by Dr. Stelzner of the Freiberg mining academy, who made a careful study of the mineral composition of the stone, to accompany the report of the late Lieutenant-Commander Gorringe. Little need be said here as to its composition. It is a hornblende mica granite, rich in feldspar, with the relatively large crystals of hornblende greatly subordinate to the mica. The accessory minerals are magnetite, sphene, apatite, and zircon. It is in no respects an uncommon rock, and in America occurs in many localities in the far west. Even in minute details it bears the closest resemblance to the granite of the great Mormon temple in Salt Lake City. For building purposes the latter rock is probably the better, being more compact and finer-grained.

The microscopic section prepared for the purpose of observing what chemical decomposition, if any, had taken place, shows almost no alteration

product due to recent weathering. A slight decay of minute mica plates may be observed, but for practical purposes it amounts to nothing. The outer surfaces of the detached pieces are equally fresh with the inner surfaces. The felspar is scarcely more altered than when the rock was lying unquarried in the hills at Assuan. The decay is not due to chemical decomposition, but to mechanical disintegration.

In preparing the obelisk for its recent coating of paraffine, the workman carefully picked off with small iron tools all the loose scale and exfoliated material still adhering to the solid rock. My friend, Mr. Samuel Parsons, superintendent of parks, informs me that this refuse weighed 780 pounds, — a truly astonishing amount, when we consider that for 3,400 years the obelisk withstood the effects of time better in Egypt than during the last five years in Central park.

In my opinion, the process of disintegration has been an extremely slow one, caused by a constant expansion and contraction of the constituent minerals near the surface, due to diurnal variations in temperature. In a climate like that of New York, where these diurnal changes are frequently excessive at all times of the year, the tension between the minerals would naturally tend to a mechanical disintegration of the rock. Granite being a poor conductor of heat, the effect of these constant changes would be felt only at short distances below the surface, causing in time minute fractures and fissures along lines of weakness. Into these openings percolating waters, upon freezing, would rapidly complete the work of destruction. The result would be what we now find, — a scaling-off, or exfoliation, of the exposed surfaces. In structure the rock of the obelisk is coarse-grained; and the minerals, being less firmly held together than in many more compact varieties, yield more readily to changes of temperature.

Observation showed that decay progressed somewhat more rapidly upon the south and west faces of the obelisk than upon the north and east. Upon the south and west the direct rays of the sun would act more intensely during the day, but the temperature by night would be nearly the same on all sides. Now, if the cause of the decay was due to expansion and contraction, disintegration would be greatest on the surfaces exposed to the severest strain (the south and west), notwithstanding that the opposite sides would be those most exposed to the driving cold storms.

It seems most probable that the obelisk, during its long exposure in Egypt, must have been slowly undergoing change, the minerals losing some of their cohesive power, and only required a lower

temperature to hasten what had been in progress for ages.

Upon this subject the experiments of Professor Wigner, published in the *London analyst* of 1878, on rock from the twin obelisk now standing on the Thames embankment, are of considerable interest. Pieces of the twin obelisk were placed at Professor Wigner's disposal by Mr. W. Dixon, the English engineer, who had charge of the removal of the prostrate monolith from Egypt to London. They represented portions from the under surface, which had been buried in sands, and also from the upper exposed surface. Both pieces were found nearly free from chemical decomposition; and analysis showed but slight oxidation of the iron in the surface rock. Experiments, however, upon the absorbent power of water of the two samples, gave widely different results. Professor Wigner estimated that the sound rock, which had been buried in sands, absorbed 7.8 grains of water per square foot of surface; and the weathered or exposed rock, 46.1 grains per square foot of surface, or nearly six times as much as the fresher rock. He says, "The 46 grains from absorption per square foot gives us a comparatively fair estimate of the amount of water which can be retained in the weathered surface, and which is ready, by its expansion and freezing, to split or disintegrate that surface still further." According to Lieutenant-Commander Gorringe, a high authority, the London obelisk, which stood at Alexandria until the early part of the thirteenth century, was probably thrown down by the severe earthquake which visited northern Africa at that time. If we may assume, as is probable, that for the greater part of the 500 years the London obelisk was partially buried in sands, the difference in the absorbent power of water in the two specimens may be taken as measure of the effect of climatic agencies in Egypt during that period.

The New York obelisk, subjected to precisely similar agencies, would be in condition, after its transportation to America, to disintegrate rapidly when exposed to a lower temperature, and the consequent freezing and melting of the water absorbed through the interstices.

ARNOLD HAGUE.

Washington, Dec. 3.

THE MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.

THE American public health association began its thirteenth annual meeting at Washington, Dec. 8.

After the opening ceremonies, a letter was read from the board of health of Montreal, stating that the epidemic of small-pox in that city was started by an imported case from Chicago, Feb. 28 of the

present year; that the spread of the disease was due to the obstinate opposition of the people to vaccination, but that it was now under control, and was fast abating, and the city would be free from the disease by Jan. 1.

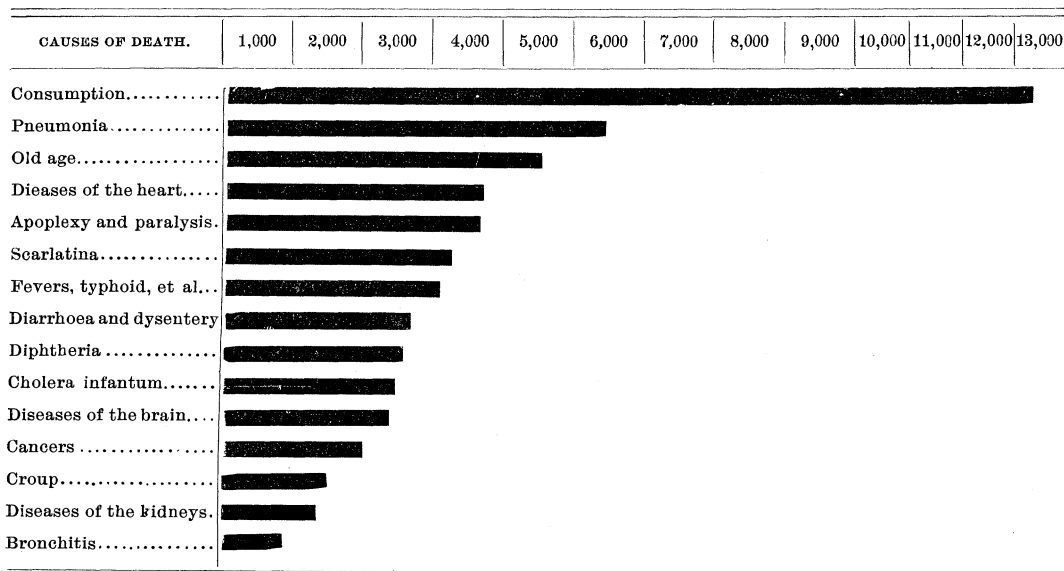
The president, secretary, and other members of the Master plumbers' association of the United States, were elected members of the association, together with eighty-eight physicians, engineers, and others interested in sanitation, representing almost every state and territory.

The secretary reported the death of nine of the members, including Dr. Thomas of Savannah,

was simply a compilation of statistics, it was not read. It showed that during twenty-five years, 1860-84, there had been in the state 13,000 deaths from consumption, while during the same period there were only 6,500 deaths from pneumonia, 4,000 from scarlet fever, and 1,000 from bronchitis; that consumption was diminishing in the state, especially among the American born; and that in Newport county, not including the city, the deaths from this cause were less than in Washington county, on the other side of the bay. For this no cause had been recognized.

The next paper was on 'Sanitary and statistical

DIAGRAM EXHIBITING THE COMPARATIVE MORTALITY BY ABSOLUTE NUMBER OF DECEDENTS FROM FIFTEEN MOST IMPORTANT CAUSES OF DEATH, IN RHODE ISLAND, DURING TWENTY-FIVE YEARS, FROM 1860 TO 1884 INCLUSIVE.



Dr. Hatch of Sacramento, and Professor McSheny of Baltimore.

The treasurer reported that he had received during the year \$3,338.13, had expended \$2,233.10, and had on hand \$1,105.03, with all debts paid.

A committee appointed for that purpose in 1883 reported that they had incorporated the association for a period of 100 years.

The committee on disinfectants presented their report in printed form, — a volume of nearly 150 pages. The discussion of it was postponed to another day.

A paper was then presented by Charles H. Fisher, M.D., secr. state board of health, Providence, R.I., on 'Statistics of consumption in Rhode Island for a quarter of a century.' As this paper

nomenclature,' by E. M. Hunt, M.D., secr. state board of health, Trenton, N.J. The nomenclature of disease is very imperfect, and as a result there was a vast amount of discussion as to etiology, which would not be if all writers used the same terms with the same meaning. The word 'hygiene' was a far better term than 'sanitation,' or than 'sanitary science.' The word 'medicine' really meant knowledge by measurement, and as used in the expressions 'state' or 'sanitary medicine' was improper and unmeaning. 'State hygiene' would be much better. The terms 'contagion' and 'infection' were also referred to as being used in different senses by various writers, — some by contagions meaning those diseases which are communicated directly by contact; by infections, those

communicated indirectly through media. Webster and other lexicographers use the terms synonymously. Dr. Hunt thinks both terms should be discarded, and the word 'communicable' substituted. The term 'zymotic,' as applied by Tarr, received its impetus from Liebig's 'Chemistry of agriculture;' but there is now, with our present views, no use in retaining it. 'Epidemic,' as applied to those diseases which affect large bodies of the people, as nations; 'endemic,' those which affect localities; and 'sporadic,' which occur isolated, — are used with various meanings. The term 'sporadic' should be abandoned. In concluding, he thought the number of terms now used in the nomenclature of disease could with great advantage to science be reduced at least one-half.

little more resistance is experienced than in hauling a similar train along a rigid road.

The automatic governing of the speed of the train is effected in two ways, — first, there is a governor attached to each motor, which interrupts the electric circuit, and cuts off the power when the speed becomes too high; secondly, there is a brake which is brought into action should the speed attain a still higher value. To avoid the formation of a permanent electric arc when the circuit is broken, the governor (fig. 2) is so arranged that the diverging weights are in *unstable* equilibrium between two stops: they fly out at about 1,700 revolutions per minute of the motor, and fly back at about 1,600. When the circuit is closed, the current is conveyed across the metallic

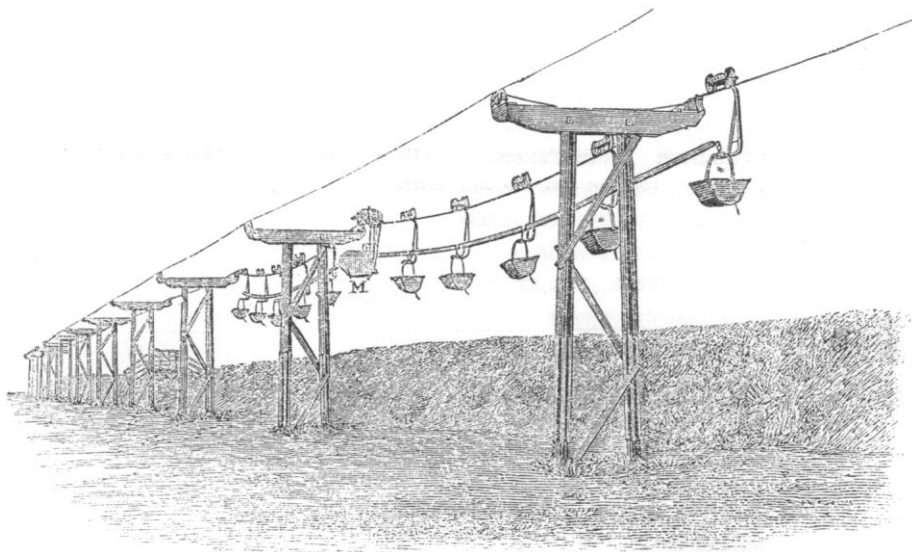


FIG. 1.

TELPERAGE.¹

THE experimental telpherage train at Glynde, England, which was described in *Science* of Nov. 13, consists of an electric locomotive, seen in fig. 1 at about the middle of the train, and propelled by the electromotor *M* (fig. 4), and ten skeps, or buckets, which hang by their travelling-wheels from the steel line. Each skep weighs 101 lbs., and carries 250 to 300 lbs. of dry clay; and by distributing these evenly, and somewhat widely apart, the strain on the steel line is small, although the total weight of the train and clay is about two tons; also, as equal weights are simultaneously ascending and descending similar inclines on the several spans, the effect of the sag on the mechanical resistance of the train is neutralized, and

¹ Condensed from *Nature* of Nov. 5.

contact at *C*. When the weights *W W* fly out, this contact is first broken, but no spark occurs, because a connection of small resistance is continued at *B* between the piece of carbon and a piece of steel, which, being pressed out by a spring, follows the carbon for a short distance as the arm *A* begins to fly out. This contact is next broken, producing an electric arc; which, however, is instantly extinguished by the lever *A* flying out to the dotted position. The brake is shown on fig. 3, and consists simply of a pair of weights, *W W*, which, at a limiting speed greater than 1,700 revolutions per minute of the motor, press the brake-blocks *B B* against the rim *C C*, and introduce the necessary amount of retarding friction. In practice, however, with the gradients such as exist at Glynde, and which do not exceed 1 in 13, the

economic method of automatically cutting off the power with the governor is all that is necessary to control the speed of the train, the brake rarely coming into action. With steeper gradients, however, the brake would undoubtedly be very useful.

The way in which a single wheel-track is made to serve for one train, or rather two wheel-tracks

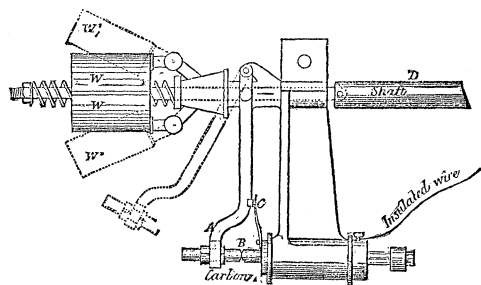


FIG. 2.

for two trains, instead of the necessity of having four wheel-tracks for two trains, as in the ordinary electric railways, is seen from fig. 4. [D is

It is found that for moderate inclines direct driving, with pitch chains, of two wheels with

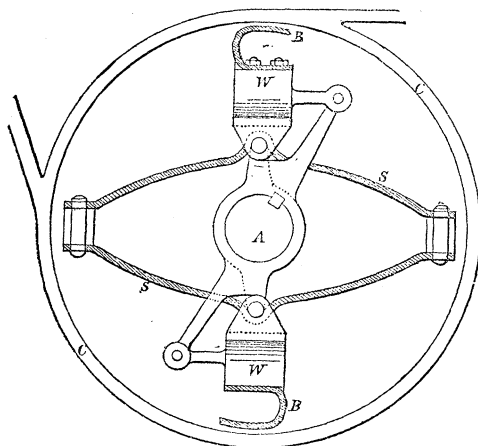


FIG. 3.

india-rubber treads, gives a gravitation grip sufficiently large for satisfactory haulage.

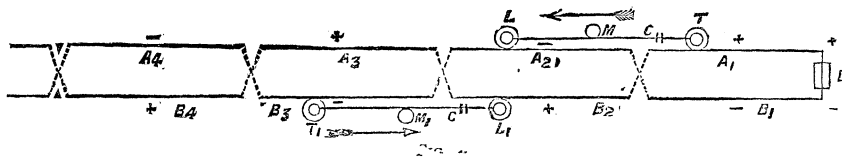


FIG. 4.

the dynamo maintaining two long conductors permanently at different potentials indicated by the signs + and - of each section. The wheels L and T of one train, and L_1 and T_1 of the other, are insulated from their trucks, and joined by a conductor attached respectively to the terminals of the motors M and M_1 . A current, consequently, is always passing from a + section to a - section through each motor. Mechanically, then, each train is supported by what is practically one continuous steel rod; but in reality at the tops of the posts the rods are electrically subdivided into sections, and joined across by insulated wires, one of which may be seen at the top of the posts in fig. 1. The wires connecting the two skeps with the motor, shown in fig. 4, are not seen in fig. 1, as they were too thin to appear in the photograph from which this figure was taken. To prevent the metallic wheels of the skeps short-circuiting the two sections as they cross the tops of the posts, there are insulated gap-pieces, which may be seen in fig. 1, at the tops of the posts where the steel rod is electrically divided.

THE PRE-COLUMBIAN HISTORY OF GUATEMALA.

THE well-known historian of Spanish America, Antonio de Herrera, in describing the first conquest of Guatemala, states that the natives of the province of Utlatlan had 'painted records,' which carried their national chronicles back eight hundred years, that is, to about the year 700 A.D.

Utlatlan was the Mexican name of the region in western Guatemala inhabited by the tribe called Quiches, whose capital city, Gumarcaah, was destroyed by Alvarado in 1524. Its ruins are still plainly visible near the little village of Santa Cruz del Quiche. So complete was the havoc of the Spanish conquerors that not a single building was left standing; and, of those 'painted records' referred to by the historian, not a shred is in existence. Fortunately for the antiquary, intelligent members of the tribe learned to write their tongue in characters devised for it by the early Spanish missionaries, and took pains to apply this knowledge to the preservation of their tribal traditions. In some cases they had a practical incentive to this

in order to vindicate their claims to hereditary lands. Hence several of these documents are called 'titulos,' or family titles.

Many of these native writings were lost; so that, of them all, only four are certainly known to be in existence. They are named in the note,¹ and it will be seen, that, while they are now all accessible in print, two have appeared only within a year, and two are merely Spanish translations without the original text. The 'Popol vuh,' or 'national book,' of the Quiches, is already well known to scholars. About one-half of it is concerned with the religious myths of the Quiches, the remainder with their historic traditions. The precise date of its composition is uncertain, but it may be assigned to the last half of the sixteenth century. The 'Titulo de Totonicapan' is officially dated in 1554; the title of the Princess Nehaib is somewhat later, and refers to lands south-west of the Quiche territory, in the province of Soconusco; while the 'Annals of the Cakchiquels' were written by a native who was already a married man when the Spanish troops first entered his country. The Cakchiquels, it may be observed, were of the same lineage and language as the Quiches, and adjoined them on the east.

These four publications, therefore, offer to students who would investigate the pre-Columbian history of Central America a large amount of authentic aboriginal material. We may say that it has never yet been utilized; for the Abbé Brasseur, in his 'Histoire du Mexique,' was utterly uncritical, and spun a romance from these writings, all of which he had consulted; while Mr. H. H. Bancroft had never seen three out of the four when he prepared his 'Native tribes of the Pacific coast,' and his 'History of Central America.' A comparison shows that all the native writers drew from some common stock of national legend; all deny that the regions they occupied were their original homes; all refer to some distant land in the west or north-west, beyond the sea, as the residence of their ancestors. An echo of ancient Nahuatl tradition floats through these earliest reminiscences. We hear of the wondrous city of Tulan, the mysterious land of Zuiva, and of battles with the Nonoalcos. But the many problems presented by these writings cannot even be men-

tioned here. As a whole, they offer the most complete body of American mythology and legend extant.

GEOGRAPHICAL NOTES.

Heights of mountains in Lapland. — Recent explorations of Swedish Lapland by Bucht Svenonius and Rabot have revealed the existence in the department of Norrbotten of a mass of mountains, of which several summits rise considerably over 6,000 feet. Their ravines enclose numerous glaciers. The highest is called by the Lapps Kebnakaisa, is situated in latitude 68°, a degree and a half eastward from the meridian of Stockholm, and between the Luleo and Torneo lakes, and by trigonometrical measurement appears to be 6,940 feet in height. The two next highest are Kaskasatjokko, 6,800 feet, and Sarjetktjokko, 6,760 feet, approximately.

Northern Norway and Finland. — The observations of Charles Rabot in the mountainous area of Store Baergefjeld, in Nordland, arctic Norway, represented on the best charts as occupied by an immense continuous glacier field, show that it has been wholly misunderstood. There is no primary glacier, but merely seven secondary glaciers, isolated in ravines, and hardly passing beyond the stage of *névé*. Their total area does not exceed six square kilometres, about one-fiftieth of the area formerly supposed to be ice-covered. The field is not a plateau, but to the north a mountain mass, whose culminating points reach nearly 6,000 feet, and which averages 3,600 feet; and to the south a densely wooded tableland, cut with myriads of deep and regular cañon-like valleys. Fir-trees three feet in diameter a yard above the ground were not rare. After completing his work on the field, Rabot made explorations in the Kola peninsula of Russian Finland, determining the existence of three distinct chains of mountains between the Polar and White seas, which reach a height of more than 3,000 feet. The country has hitherto been charted as a sort of plain, broken merely by lakes and low hills. The area between the ranges is level, and trees of good size and form reach latitude 68° 50'; beyond they extend some distance, but do not exceed twelve or fifteen feet in height. Collections were made of geology, terrestrial and fluviatile mollusks and fishes.

Connecting the Volga and the Don. — The project of connecting the Volga and the Don dates back to 1568, when Selim, the son of Solymán the Magnificent, besieging Astrakhan, attempted to join the two rivers in order to transport material of war. His work was brought to an end by the power of Ivan the Terrible, czar of Moscow. In 1700, aided by John Perry, an English engineer,

¹ *Popol vuh; le livre sacré des Quichés*. The original text, with a French translation by the Abbé Brasseur de Bourbourg. (Paris, 1861.)

Titulo de la casa de Ixcuin-Nehaib. Edited by Don Juan Gavarrete. (Guatemala, 1873.)

Titulo de los Señores de Totonicapan. The Spanish text, with a French translation by M. le Comte de Charencey. (Alençon, 1885.)

The annals of the Cakchiquels. The original text, with an English translation by Dr. D. G. Brinton. (Philadelphia, 1885.)

the work was attempted by Peter the Great, but at the end of a year, after his defeat at Narva, Peter abandoned the project, which has since that time been periodically discussed. In October last M. Léon Dru, a French engineer, having surveyed a line, was convinced that the project was practicable, and experimental borings have already commenced.

A ruined city found in Asia Minor. — In the province of Adana, Asia Minor, not far from Tarsus, at a few hours' travel from the sea, among the mountains, has recently been discovered a ruined town hitherto entirely unknown. The ruins lie near the route from Sélef-Ké to Karaman by Mohara. Sarcophagi almost intact, and resembling those of Lycia, exist there, and would seem worthy of study.

Monuments of Babylonian times. — It is stated that an archeological expedition, under Professor Niemann of the Academy of fine arts, is fitting out in Vienna for the exploration of those parts of Taurus and Anti-Taurus where last year were found remains of monuments dating from Babylonian times.

Siberian interest in geographical exploration. — An exploration, to cover a period of five years, is being organized by Yadrintseff, under the auspices of the Russian geographical society. Its purpose is the investigation of the ethnology and social economy of Siberia. The party will consist of young men, who will be distributed over different parts of that immense region for purposes of study. Residents of Siberia have already manifested a laudable interest in such investigations; and beside museums at Irkutsk, Omsk, Yeniseisk, and Tomsk, M. Martianoff, at Menusinsk, in the Yenisei government, has already gathered a collection of more than six thousand archeological and ethnological specimens.

The trans-Siberian railway. — The trans-Siberian railway has already finished its first section of 135 kilometres between Ekaterinburg and Kamishoff, and its early completion to Tiumen is confidently expected. The canal between the Obi and the Yenisei is already so advanced that navigation will probably be inaugurated on it by the spring of 1887, if not even earlier. Sibiriakoff has established a line of steamers on the Angara, which unites Lake Baikal to the Yenisei, and which has been thought too turbulent for navigation.

The old bed of the Oxus. — Daniloff, in examining the Oxus, has found what he reports to be the point of its ancient bifurcation into the Amu Daria and the Uzboi. In opposition to the opinion of M. Lessar, chronicled in these pages, but confirming that of Kalitine, Daniloff believes that the

latter is right in his mapping of an ancient river-bed in the desert, called the Uzboi or Unguz. This will soon be levelled throughout its extent, and the conflict of opinion be settled by the more exact methods of a careful survey.

ASTRONOMICAL NOTES.

Equatorial currents in solar and planetary atmospheres — Of the bodies of the solar system, the sun, Jupiter, and the earth are the only ones that have thus far distinctly shown any decided difference of rotation-period, either for different parts of their visible cloud-surfaces, or for a gaseous atmosphere and the solid or cloud-surface above which it sweeps. Of these, Jupiter offers by far the greatest variety of detail, but it has never been adequately observed until the sudden appearance of the 'great red spot' in 1878 attracted universal attention to the planet. The result has been, that not only has this red spot, which is still visible, been shown to have a definite and nearly constant rotation-period, not varying many seconds from $9^h 55^m 37^s$, but certain white spots upon equatorial belts are found to be permanent features for several years in succession, and to have a rotation-period (about $9^h 50^m 10^s$) decidedly shorter than that of the red spot, but equally constant; so that their conjunction-times, as they sweep by each other, can be predicted pretty accurately. Detailed micrometric work upon these spots and belts, like that described in Professor Hough's annual reports, is especially valuable, and there is plenty of work still to be done upon the other details of the planet's cloud-surface. As to the sun, it is well known that the spots give a rotation-period of about 25 days for the solar equator, slowing up to about 27.5 days at latitudes of 45° , beyond which there are not sufficient data for fixing any period. But we think hardly sufficient attention has been paid to the fact that Professor Young's observations (*Amer. Journ. Sc.*, 3d ser., xii. 331) upon the displacement of lines in the spectra from the east and west limbs of the sun gave for the equatorial velocity of the chromosphere $1.42 \pm .035$ miles per second, while the equatorial sunspot-period gives only 1.25 miles for the photosphere. It is a pretty strong indication that the solar atmosphere sweeps forward over the photosphere; and its bearing upon the probable behavior of the corona and meteoric matter falling into the sun would seem to call for a redetermination of this line-displacement with the more powerful dispersion now available in Rowland's gratings. As to the earth, we know that the general drift of the lower atmospheric currents is eastward, rotating faster than the globe itself; but of the circulation high up above the clouds we knew absolutely nothing until the red

sunsets following the Krakatoa outburst (whose explosion of 1883, Aug. 27, drove whole cubic miles of dust and steam, if not clear through our atmosphere, at least many times higher than the clouds ever float) indicated by their successive appearances at different places a probable upper equatorial current moving rapidly westward, i.e., rotating slower than the earth. We do not think the discussion of these red sunsets is, from this stand-point, by any means exhausted, and hope that Professor Kiessling of Hamburg, who has so well explained the physical causes of the phenomena, will publish the thousand or more records he has of the first appearances of the red sunsets all over the world. The only other occasions when these upper currents can be observed are the rare chances when the drift of a long-continuing meteor-streak might be determined from two or more observatories. If workers with equatorials would endeavor, on those rare occasions when a meteor-train remains visible, quickly to begin a series of pointings (using the lowest power) alternately upon the two ends of the streak, noting the times and reading the hour and declination-circles as rapidly as possible, we might in time accumulate some valuable data about the upper currents in our latitudes; but observatories near the equator are scarce. However, the knowledge thus gained of the heights at which meteors appear would be much more accurate than from the ordinary alignment among the stars, and these observations ought to be made on every possible occasion by astronomers.

Two new comets.—Two new comets have already been discovered during the present month. The first was found on Dec. 1, at Paris, the name of the discoverer not being given in the telegram. The comet was readily picked up by Professor Frisby of the Naval observatory with a 2½-inch finder, and the following observations were obtained with a 9.6-inch equatorial:—

Date.	Wash.M.T	<i>a</i>	log <i>p. Δ</i>	<i>δ</i>	log <i>p. Δ</i>
1885.					
Dec. 2	9h 20m 2s	0h 36m 11s.11	9.285	+21° 0' 26".2	0.460
" 3	8 10 56	33 53.93	8.796	20 58 46 .7	0.433
" 6	6 27 6	27 7 .81	9.079 n	20 54 3 .5	0.443
" 7	6 58 54	24 50 .81	8.593 n	20 52 35 .7	0.434

It has been described as ill-defined, and slightly condensed towards the centre, — without a tail. The second comet is announced in a telegram from Prof. Lewis Swift, who states that the comet was discovered by Mr. E. E. Barnard of Nashville, Tenn., on Dec. 3, its position being at 9h 37m (probably Washington mean time) R.A., 4h 21m 57s; Dec., + 4° 45'. The motion is given as 35 minutes, but the direction of the motion is made unintelligible by the ambiguous term 'north west.'

In the position just given, the comet would pass the meridian a few minutes before the bright star Aldebaran, but nearly twelve degrees farther south.

NOTES AND NEWS.

THE work of the Henry Shaw school of botany, St. Louis, outside of the university classes, will begin with the formation of a class for the study of grasses. For the accommodation of teachers in the schools of the city, this class will meet from 9 to 1, on Saturday mornings. A class in analytical botany will take up the study of spring flowers on Tuesday and Thursday afternoons, and Saturday mornings, from April 6 till June 12, 1886.

— Those interested in composite photographs will find a plate of four of members of the National academy, in *Science* of May 8, 1885; another, from a composite photograph of several skulls, in the number for June 19; a third, of the officers of the American association at the Philadelphia meeting, in the issue of Aug. 28; and a fourth, showing the racial characteristics of Jews, in *Science* of Oct. 9.

LETTERS TO THE EDITOR.

. Correspondents are requested to be as brief as possible. The writers' name is in all cases required as proof of good faith.

Newcomb's 'Political economy.'

PROFESSOR NEWCOMB objects, in the last number of *Science*, to certain things in my recent notice of his work on political economy, charging me with 'atrocious misrepresentation' of his views. The quotation-marks enclosing two sentences in the first paragraph of my review should not have been there, and, so far as they led my readers to think that they indicated Professor Newcomb's own words, they were misleading; and an apology is due Professor Newcomb from me, which is hereby tendered. I may simply say, by way of explanation, that the proof of my article was not submitted to me in time to receive any corrections at my hands before it was printed, or the offending marks, as well as the word *always*, to which the author objects later in his letter, would certainly have been expunged.

As to the chief point at issue, however, viz., whether my article presented a correct view of Professor Newcomb's theories, I have nothing to take back or change. I have again examined Professor Newcomb's book, in connection with his strictures on my review, and do not see wherein I have misrepresented him. The point in dispute, of course, is not what Professor Newcomb desired or tried to do, nor even what he claims to have done, but simply what he actually did do in the work reviewed. It is true that he expressly disclaims any intention of doing what I maintain he has done; but this is no evidence, of course, that my view of his actual work is erroneous. The notice contained my opinion of the real work, and not of the author's

intentions. The proof of the correctness of my opinion cannot be given within the space which you can allot to the discussion, since it involves a careful comparison of Professor Newcomb's premises and conclusions, of his declared intentions and his actual success. The following sentences, taken somewhat at random from the book, seem to me to prove the general justness of my view. The italics are mine. Page 543 (Summary of principles): "The motives which animate men in the pursuit of wealth are in the highest degree beneficent, and have led to a system which insures to every man fit to live the maximum of enjoyment from his labor, if he will only adapt himself to the system." Page 518: "It is also to be remembered that the existing system insures the employment of every man in the way best suited to his talents better than any other system possibly can. This fact follows from almost the whole system of political economy, so that it need not be further dwelt upon." Pages 517 and 518: "Thus, from an idealistic point of view, nothing can be said against the general equity of the existing system of free competition." Page 516: "It is a great mistake to suppose that the enormous inequalities which we see in wealth imply any thing wrong in the system which permits them." Page 370: "We have already shown that in the state of things which now exists in this country it is scarcely possible for any industrious man to suffer for the necessities of life."

These quotations, it seems to me, present a fair view of what should be regarded as the logical outcome of the methods and principles of the book. The author is not consistent in his reasoning, and this leaves him abundant opportunity to quote passages which are at entire variance with what I represented as the result of his effort. It should also be said that they are at entire variance with the conclusions above quoted; which latter are, in my opinion, more in harmony with the general drift of the book than the former. As one interested in the progress of the science, I am glad to know that Professor Newcomb recoils with such vigor from the logical consequences of his theory, as we may hope that his influence will at last be thrown in the direction of sounder methods than those which he so vigorously repudiates and so closely follows.

In conclusion I should like to say that my objections are nearly all to the general methods and tendencies of the book. I think, as I said in essence in my review, that many of the minor discussions are admirable and suggestive. E. J. JAMES.

Professor Newcomb may well repeat the ancient prayer to be delivered from his friends, if Mr. Franklin's letter fairly represents their best efforts. With the single exception of what has been already mentioned, the latter is exceedingly unhappy in his strictures.

To begin with his last point, he remarks that the closing sentence of my review was "entirely and absurdly gratuitous, as Professor Newcomb was describing what governments do when they establish an unlimited bimetallic system." Professor Newcomb's original sentence might possibly have been excused on the ground of carelessness of statement; but if he should agree with Mr. Franklin, and still desire to stand by it in its actual form, it would simply be another instance of one of my chief objections to Professor Newcomb's general methods; viz., that he is dealing all the while with imaginary quan-

ties. It is safe to say that neither Professor Newcomb nor Mr. Franklin can adduce a single historical example where "governments, in establishing a bimetallic system, assumed that the values of equal weights of the two metals have a certain fixed ratio to each other." They have sometimes assumed that by establishing such a system they can do much toward creating such a fixed ratio, which is an entirely different thing. The statement of Professor Newcomb is doubly objectionable, — in the first place, because it is not true; and, in the second place, because it is the form usually adopted by one-sided monometallists in describing the position of bimetallics, so that they may forestall discussion by ascribing to their opponents such an absurd theory as to make them appear a pack of drivelling idiots. I prefer to think that Professor Newcomb does not desire to bolster up his position by any such questionable devices.

Mr. Franklin asks how much of the influence of recent German writers on economic science is traceable in Professor Sidgwick's book. The mere question proves one or both of two things: 1°, that Mr. Franklin is only superficially acquainted with Professor Sidgwick's work; or, 2°, that he knows nothing of recent German writers on political economy; or, 3°, both. The influence of German thought is evident on nearly every page — certainly in every chapter — of Professor Sidgwick's book. Some of the chapters, indeed, — notably the one on public finance and that on distributive justice, — might almost be called abstracts of Wagner. I did not say that Professor Newcomb knows nothing of recent political economy, but simply that his treatment of the subject shows no traces of such knowledge. To give evidence of such knowledge, it is not necessary, of course, to quote from recent works. One might reveal the fact in one's methods and conclusions that the gigantic movements of the last generation had not swept by without in some degree affecting the views of the writer. A man who writes a work on physics need not stop to trace out the authority for each statement he makes in order to show that he is abreast of the time. To do that would be as absurd in form as it would be in reality, if he attempted to write such a book without taking any notice of the work done in that department within the last generation.

Whether it be evidence of ignorance and incompetence in any field to adhere to the system of a past generation when another system, whatever may be its merits or defects, has certainly displaced the old one, may fairly enough be left to the sober sense of men of science and to the practical answer of a moving world. It seems pretty clear that Mr. Mill, to whose methods and system Mr. Franklin implies that Professor Newcomb adheres, would indignantly repudiate any such views as those above quoted from Professor Newcomb's book, since he regarded them as already obsolete at the time when he wrote.

I did not say, nor did I mean to imply, that Professor Newcomb had just begun to make excursions into the economic field, but that these excursions had always been of a hasty and desultory character, since the better part of his life and effort had been devoted to something else; and, further, that the whole tenor of his introduction was that we should now see an example of the true scientific method, the failure to apply which, so far, was the real secret of the failure of political economy. E. J. J.

The Biela comet meteor-stream.

The showers of meteors from this stream (see *Science*, vi. 489 and 496) were observed not only very extensively on the night of Nov. 27, but also at some places on nights preceding and following this; and a complete collection of all the observations should be made in order to study the distribution of matter in the stream. We should be glad to receive from everywhere reports of observations of these showers; and they should give, as fully as may be, the following data: 1°. The time the observations commenced, whether in twilight or darkness, and whether the shower seemed to be beginning or already in full operation. 2°. The clearness of the sky, and freedom from interference of trees, street-lamps, etc. 3°. If a continuous count was kept, the rate at which it proceeded (as illustrated on p. 490 of last week's *Science*), the number of observers, and how stationed. 4°. If no count was kept, then the time of any marked variations in the density of the shower. 5°. The time the observations ended, and whether the shower appeared to be over; and, if so, whether any further watch was kept for a renewal of it, and how long. 6°. The appearance of the meteors, especially the color of the brighter ones and of their trains, if any; also if any appeared to describe curved paths. 7°. If the observer was reclining so as to watch all round the radiant equally well, or, if there was an observer for each quadrant, then some approximate indication, if possible, of the relative density in each quadrant; and, if this varied decidedly, then the times of the variation.

Probably few can give much information on the last point, but it would be valuable in discussion of local differences in the showers. There are some indications of this at stations not many hundred miles apart, which, if they are real, indicate a considerable *bunchiness* in the meteor-stream within very moderate distances. These will always be interesting showers to observe, not only for their connection with the lost comet, but also because they come into our atmosphere with low velocities, nearly on the following side of the earth, and hence are conveniently observed in the evening and with the radiant near the zenith, — very rare characteristics of well-marked showers.

Some features of the meteor-orbit may be of interest. Assuming the elements which Santini computed (*Astr. nachr.*, L. 124) for the unobserved return of the comet in 1859 as the latest computation of its probable motion, they show that the orbit is an elongated ellipse inclined about 12° to the earth's orbit, with a perihelion distance of .87 (the earth's mean distance being unity) and an aphelion distance of 6.21 (Jupiter's mean distance is 5.20), and that the aphelion is only .92 from the plane of the ecliptic; thus making it highly probable that Jupiter pulled the comet into the solar system originally, and showing that it can still perturb its motion considerably. The most interesting feature (the one which makes the meteor-showers possible) is that, according to Santini's elements for 1859, the radius-vector of the comet at its descending node equals .992, while that of the earth at this point is .986, — an approach within .006, or about 550,000 miles. This small distance, however, is liable to have been changed by several times its whole amount by perturbations since then.

At this node the velocity in the comet-orbit is 24.3 miles per second, while the earth's is 18.7; and as the motion of the comet is direct, the inclination only

12°, and the angle between the radius-vector and the normal of the comet-orbit only 18°, the meteors enter the earth's atmosphere from the apparent direction of the radiant in Andromeda, with a velocity of only 9.8 miles per second, thus causing their sluggish motion, which perhaps would be even more marked were it not likely, that, on account of their slow speed, they are consumed at a somewhat lower level than the swift showers, and hence appear relatively too fast from greater proximity.

Of course, there can be no shower unless there are meteorites scattered along that part of the orbit where the earth reaches the node about Nov. 27. Santini's elements make the passage through the node about thirty days before that through perihelion, and give the following series of times for the successive crossings of the node, the period being 6.67 years. The next column gives the elapsed intervals from these times till the nearest earth-crossing about Nov. 27.

Date of comet's node-passage.	Distance of comet beyond node Nov. 27.
1859.31 (April 23)	-5 months.
1865.98 (Dec. 24)	-1 "
1872.65 (Aug. 25)	+3 "
1879.32 (April 27)	-5 "
1885.99 (Dec. 27)	-1 "
1892.66 (Aug. 29)	+3 "
1899.33 (May 1)	-5 "

The only recently observed showers certainly attached to this stream, so far as known to the writer, are those of 1872, when the comet was already three months past the crossing, and the one just happened, when, according to the same elements, the comet should not have crossed till a month afterwards. There appears to have been no well-marked shower observed in 1865, when, with unperturbed elements, the circumstances should have been almost the same as this year; and the difference is, no doubt, due to the increased diffusion of the stream and the perturbations since 1859. The phenomena of 1892, as compared with those of 1872, will furnish some evidence on this point; but, as the perturbations of this stream are pretty large, the above times may very likely be wrong by some months at the end of the century.

This is by far the most interesting meteor-stream we have to deal with as yet, and the study of its special perturbations would seem to be well worth making. After the passage of the double comet in 1852, the *Academie des sciences de St. Petersburg* offered a prize (*Astr. nachr.*, xxxviii. 95) for a full discussion of the whole theory of the comet from its discovery in 1826 to its expected re-appearance in 1859; but no one seems to have undertaken the work at that time. Perhaps its discussion at this day, extended to its perturbations as a diffusing meteor-stream, would be worthy of a prize.

H. M. PAUL.

Washington, Dec. 5.

The Biela meteors.

On the evening of Friday, Nov. 27, at 6.15, I observed a meteoric shower of considerable proportion. In taking a casual glance at the heavens after tea, my attention was at once attracted by several meteors, which followed in such rapid succession that I was able to count twenty in less than five minutes. They appeared all over the heavens, and, among the great number observed during less than half an hour, the radiant point of but one was other than in the con-

stellation Perseus. My observations were unavoidably interrupted. At 10 o'clock I again scanned the heavens, but the shower had then subsided.

ROBERT D. SCHIMPF.

Scranton, Penn., Nov. 28.

Natural gas in Illinois.

In an editorial note in *Science* for Nov. 20, there is a reference to the failure of the natural gas-wells in Champaign county, Ill. In all, there are only about a dozen gas-wells in this county. In two, which are near together, the pressure is about twenty-five pounds per square inch: in the others it is only a few pounds. After personally investigating a number of wells, the writer concludes that there has been no marked decrease in the supply, the failure of any particular well being due to an accumulation of mud and water rather than to an exhaustion of the supply. With one exception, all the wells require pumping out every two or three months. The gas is nearly pure marsh-gas, and is found at a depth of 70 to 90 feet, in a layer of loam from 3 to 12 feet thick. Inferences drawn from the Champaign county wells are inapplicable to the Pittsburg wells.

Near Litchfield, this state, natural gas has been found which in quantity, quality, and source, is similar to that of Pittsburg.

I. O. BAKER.

University of Illinois.

International geological congress at Berlin.

I have just read in *Science* for Oct. 30 your interesting article on the international geological congress at Berlin. Will you permit me to point out one error which has escaped your attention? It is in regard to the bracketed clause which comes at the end of the first column on p. 378: 'the lower . . . beds.' This phrase is inaccurate. Professor Geikie asked for the suppression of the words 'lower carboniferous' and 'calcareous sandstone.' I accepted this without opposition because it was expressly understood that the typical localities referred to in my report (Kilborkan, Marwood, Pilton, Dura Den) ought to be included in the upper Devonian, as the report of the commission defines it.

As to the following sentence, 'The whole paragraph (c) was afterward suppressed,' I do not know upon what it could have been founded. I have not the least recollection that there was any suggestion of the suppression of that paragraph, and you can be sure that such a proposition would have given rise to an animated discussion.

G. DEWALQUE.

Liège, Nov. 13.

The English sparrow.

The American ornithologists' union has collected evidence from all parts of the country where the English sparrow occurs, and has published a report based upon their investigations. As I stated in *Science* (No. 144), they have urged that laws be passed against it, looking to its entire extermination. Acting upon this advice and upon experience with the pest, several states have repealed their protective laws, and the bird is now under the ban. Every one who has seen the bird in the east knows that it drives away native birds, destroys fruit, and is disagreeable in every way.

In regard to a means of destruction, let every

state offer a small bounty for birds and eggs, and the small boys will do the work. A bird is not at all comparable with locusts or mosquitoes. Intelligence, or instinct as we may call it, makes the vast difference. We might persecute insects till the end of time, and they would still come upon us each year; but birds are very quick at seeing whether or not they are wanted. If they are persecuted, they instinctively draw away from man, as in the case of the crow. We may not be able to entirely rid ourselves of the pest, but we can at least succeed in driving them away from the cities; and once get them into the country, where they can be taught to fear the shotgun, and we shall have them at least under our control. They can be driven away from the cities if their nests are demolished as soon as made, and if all the bird-houses are removed. A careful use of poison might also work with advantage, and in the large parks the shotgun in the hands of competent men could be brought into use.

I will add that if any of the readers of *Science* are troubled with the sparrow in ivy or other vines, by sprinkling red pepper among the leaves they will soon be rid of the pests. This has been tried with success.

RALPH S. TARR.

Washington, D.C., Dec. 4.

The results of shad propagation on the Atlantic coast.

In your issue of Nov. 13, p. 434, I see it stated by Colonel McDonald that the rivers draining into the Atlantic, from Cape Cod to the capes of the Chesapeake, together with the submerged continental border lying between the coast-line and the Gulf Stream, constitute an area "within the limits of which the migrations of the shad are confined."

Is this true? It certainly was not true sixteen years ago; for at that time, I am quite sure, shad were abundant in all the southern rivers. I well remember that they were especially abundant and fine in the Ogeechee, ten miles south of Savannah. I have not been in the southern states in shad season since 1869, and therefore cannot speak from personal observation since that time, but I have no doubt that the same is still true.

JOSEPH LECONTE.

Berkeley, Cal., Nov. 21.

Crystals in maple sirup.

I send you a photograph, kindly furnished by Mr. Arthur W. West, of some large crystals which formed on the inside of a glass jar of maple sirup. The sirup was made from the rock maple, *Acer saccharinum*, during March, 1885, by Elias Fogg, Esq., of Maple Ridge, Sandwich, N.H. As this is the first time that crystals have been noticed to form in the sirup by Mr. Fogg, or any one in Sandwich, I thought it worthy of notice. I would suggest as a theory to account for this crystallization that for the past two or three seasons there has been a considerable drought in that part of New England, and the maple-trees have therefore been less gorged with water than formerly, so that the sap is composed of a larger proportion of sugar as it comes direct from the trees. Mr. Fogg says that there has been no difference in the process of making the sirup, but that it keeps better, and is less liable to mould.

J. H. SEARS.

Salem, Mass.

SCIENCE.—SUPPLEMENT.

FRIDAY, DECEMBER 11, 1885.

PHYSIOLOGY OF THE BRAIN.

THE recently published memoir of Dr. J. Steiner¹ is an especially important contribution to this very difficult field of research, and one which is likely to have influence not only from its intrinsic merit as an investigation, but also from the unusual literary excellence characterizing the author's presentation of his subject. The frog was chosen for the experiments on account of the comparative simplicity of its brain. The experiments consisted in a series of systematic removals of portions of the brain; and to the thoroughness and patience with which this system of study was executed the success must be attributed. Steiner removed first the hemispheres, and records in his memoir the observed results; next both the hemispheres and optic thalami; then the mid-brain; then the cerebellum; finally the upper part of the medulla. Then follow experiments with asymmetrical removals. Together with the description of each operation is given the account of the physiological phenomena which ensue from it. The discussion of the interpretation of the observations is kept separate, — an essential advantage to the reader.

The most important conclusion reached is, that in the anterior portion of the medulla oblongata there is a common centre for the co-ordinated movements of the head, rump, and limbs; or, in other words, that we cannot separate the three centres topographically, and can establish the fact of their organic connection. This central office Steiner names the brain-centre (*hirnzentrum*). By ingenious experiments and reasoning he renders it probable that the upper parts of the brain (*bigemina*, etc.) contain no general co-ordinating motor-centres, but only sensory centres and pathways; that is to say, they act to the brain-centre the rôle of centrifugal nerves, and the brain-centre is the only locomotion centre of the body.

The relation of the brain-centre to the reflex centres of the spinal cord is very remarkable, and is demonstrated by the reactions of a frog deprived of its hemispheres to irritations produced by varying strengths of sulphuric acid placed on the skin. The strength is gradually increased until a reaction occurs. The first reaction is a locomotion; a little

stronger, and there is first a locomotion, and then the well-known reflex wiping motion to remove the irritant; the wiping motion causes the stoppage of the locomotion — the interpretation of this fact is that the brain (locomotion) centre is more readily excited than the reflex centre in the cord, and that the reflex centre inhibits the action of the brain-centre. This is another of the increasing number of instances of the reaction consequent upon stimulation of a given part varying with the strength of the stimulus. This discovery already appears to us of very far-reaching significance for the future of nervous physiology.

In a second chapter the author establishes asymmetrical injury of the brain as the cause of compulsory curvilinear motions (*mouvements de manège, rollbewegungen*, clock finger movements, etc.). For further details we must refer to the interesting original.

Dr. Josef Paneth brings a new contribution¹ to the solution of the vexed question whether the cortex cerebri of new-born animals is irritable. He attributes Toltmann's negative results, which are accepted in most text-books, to the use of narcotics by that experimenter, and reports thirteen experiments made by himself on dogs, of which eight gave a positive, four a probably positive, and one a negative result. It may be added that animals which are born more advanced in development (as, for instance, guinea-pigs) have been already shown to have an irritable cortex at birth. The only irritable area was half a square centimetre in the region of the sulcus cruciatus. Microscopical examination showed the absence of medullated fibres in this region, so that Toltmann's view that their presence is essential to irritability is not sustained. Paneth's results agree with those previously reached by Lemoine.²

C. S. MINOT.

GEOLOGICAL SURVEY OF CANADA.

THE Dominion of Canada embraces nearly half the continent; but the greater part of this vast area is still a trackless wilderness; and the labors of the geological survey, in its earlier decades, were wisely concentrated upon those districts in the eastern provinces and the valley of the St. Law-

¹ *Ueber die erregbarkeit der hirnrinde neugeborener hunde.* Von J. PANETH. *Pflüg. archiv f. physiol.*, xxxvii, 202.

² Lemoine, *Contribution à la détermination et à l'étude expérimentale des localisations fonctionnelles encéphaliques.* Paris, 1880.

¹ *Untersuchungen über die physiologie des froschhirns.* Von Dr. J. STEINER. Braunschweig, Vieweg, 1885. 8°.

rence which are and must always remain the chief seats of population and wealth, and an accurate knowledge of which must therefore always be of prime importance. This result is now in a large measure accomplished; and meanwhile the external conditions have greatly changed. The Canadian Pacific railway has connected the Gulf of St. Lawrence with the Gulf of Georgia, and flourishing communities have arisen in British Columbia and Manitoba. With this tide of immigration and development in the far west has come not only the possibility, but the necessity, of greatly extending the field and changing the plan of the survey. The outlines of the geology of a vast region are being rapidly traced, while the elaboration of details is mainly left to the future, save where there is promise of important economic developments.

The 'Report of progress of the Canadian geological survey for 1882-84,'¹ includes, besides the summary report of the director and two contributions from the chemist of the survey on the composition of the coals and lignites of the north-west territory, and various building stones and ores, thirteen separate reports on explorations, in nearly as many different sections of the dominion. These are arranged in geographical order, beginning in the far west; and it is therefore especially surprising to find that the first report was written twenty-five years ago, though now published for the first time. This is an account of the geology of the country near the 49th parallel, west of the Rocky Mountains, by Mr. H. Bauerman, geologist to the boundary commission. The publication of these rather antiquated observations seems to be justified by the fact that they largely relate to districts which have not been covered by more recent explorations.

This is followed by the most important of recent contributions to Canadian geology; Dr. G. M. Dawson's final report of 170 pages, on the region of the Bow and Belly rivers, embracing an area of about 27,000 square miles of prairie and plateau country lying in the angle between the United States boundary and the eastern base of the Rocky Mountains. This district, which touches the paleozoic rocks of the mountains, and is based on the cretaceous and Laramie formations, is the first in the north-west territory of which a systematic and proximately complete examination has been made, and is of special importance in consequence of the proximity of the valuable coal and lignite deposits to the line of the Canadian Pacific railway. These are shown to be wide-spread and practically inexhausti-

ble; and the main geological features are so clear and easily read, that, although the details are largely left to the future, the present report and map will be found adequate for a long time. The treeless character of the plains is in a large measure offset by the fossil fuels, but their aridity is not thus mitigated. That the climate has become drier in post-glacial times, is very plainly indicated by the broad, deep drainage channels known as *coulées*, which were evidently formed by large rivers, but are now dry, or nearly so.

Dr. Robert Bell's report on the Athabasca River gives the results of a rapid geological reconnaissance of the valley of that stream from the 55th parallel to Lake Athabasca. We have here the first definite information concerning a geological section, which, like that on the Bow and Belly rivers, is chiefly remarkable for its simplicity and its promise of important economic developments. It consists of cretaceous marls and sandstones resting horizontally but unconformably on horizontal beds of Devonian limestone; and the lower part of the cretaceous is, over an area of thousands of square miles, supersaturated with asphaltum and petroleum. In no other extensive petroleum-field, probably, are the conditions so simple and so clearly exposed as here. It is very much as if the two thousand feet of barren rock covering the oil-sands of Pennsylvania were removed. In the Athabasca field, too, the much-vexed question of the origin of petroleum seems to find a ready solution, the facts affording substantial support to the theory that the oil has its source in the underlying limestone, which is distinctly oleiferous.

Dr. Bell also accompanied the expedition sent out in 1884 to establish meteorological stations at various points in Hudson's Strait and Bay. But he enjoyed no special facilities, and the desultory observations here published are all that could have been reasonably expected, even from so experienced an observer, especially considering that he was not only the geologist, but the zoölogist, botanist, taxidermist, photographer, and medical officer of the expedition. The glacial phenomena, past and present, received most attention; and the interesting fact is established that the top of the coast-range of Labrador projected above the ice-sheet, and was not glaciated. This report is accompanied by lists of the plants, mammals, birds, crustacea, marine invertebrates, and lepidoptera collected.

Professor Laflamme's observations on the Saguenay have so greatly extended and multiplied the known areas of Trenton limestone as to suggest that this rock may once have covered the Laurentian highlands continuously from the St. Lawrence to Hudson's Bay, this part of the continental nu-

¹ *Geological survey of Canada. Report of progress for 1882-84.* ALFRED R. C. SELWYN, director. Montreal, Dawson, 1885. 8°.

cleus having been completely submerged by the sea of that period. But it must have been dry land previously, since no traces of the Chazy, calciferous, and Potsdam are found beneath the Trenton, which rests directly and horizontally upon the Laurentian gneiss, and is so related to the present elevations and depressions of the gneissic surface as to indicate that they are in large part the result of erosion in pre-Cambrian times.

The reports by Messrs. Ells and Low on the Gaspé Peninsula, with the maps, indicate considerable progress in the elucidation of this small but very formidable wilderness; and Mr. Ells's notes on the geology of Prince Edward's Island prove that the so-called triassic beds of this island belong almost wholly to the Permo-carboniferous.

Prof. L. W. Bailey continues his investigation of the geology of New Brunswick in a report on Carleton and York counties, which is devoted chiefly to the Silurian and supposed Cambro-Silurian strata. The latter consist mainly of highly crystalline gneisses and schists; and the only evidence of their Cambro-Silurian age consists in the fact that they are overlain unconformably by the Silurian beds, coming between the latter and the great granite axis, by which it is supposed they have been metamorphosed.

Mr. R. Chalmers describes at considerable length the interesting glacial phenomena of the same region.

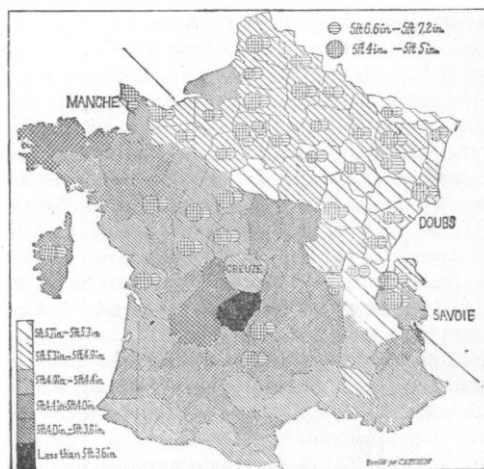
Mr. Hugh Fletcher's extended report on the northern and hitherto unsurveyed portion of Cape Breton, with the accompanying map of the whole island, places the geology of this province on a par with that of the rest of Acadia. The scale of the map, which covers 24 sheets, is entirely too liberal, being at least twice as large as either the topographic or geologic details require; and the bulkiness of the map seriously diminishes its usefulness, especially in the absence of a general map of the island on one sheet.

The remainder of the volume is made up of detailed reports on the apatite mines and deposits of Ottawa county, and the gold mines of the Lake of the Woods, and some scattering observations on the mines and minerals of Ontario, Quebec, and Nova Scotia.

HEIGHT IN FRANCE.¹

IN the accompanying map of France the average height of the inhabitants is indicated by the shading, in which the darker shades denote the smaller, and the lighter shades the greater heights. It will be seen that a line, as shown on the map,

running diagonally from Manche in the north-west to Savoie (Lyons) in the south-east, divides the country into two parts. To the north-east of this line the inhabitants are above the average height; to the south-west of it, below the average. This phenomenon was known to Broca, who ascribed it to racial influences alone. He held that the Celts and the Cymri mentioned by Caesar were the racial ancestors of the present French people. The Celts were of mean height, and were further distinguished by their round heads and bulging foreheads, and light hair and eyes; while the Cymri (or Belges of Caesar) were tall, and had long heads, with broad, high foreheads and light hair and eyes. Broca had also pointed out that unusual deviations from the average height were more common in those regions which we may regard as the country of the Celts, and rare among



the Cymric people. Broca prepared his map according to the frequency of the deviations from the average height, and his result is quite similar to what is obtained when, as in the present instance, the average height itself is the basis of comparison. In both cases France is divided by a line from north-west to south-east into two parts, the inhabitants of one of which are markedly taller than those of the other, while about the same regions appear as the extremes either of tallness or smallness in both cases.

It is well known that if the height of a large number of men are taken, and the number of men at each height be recorded, the largest number of records will centre about the mean height of the whole group, and the number will grow smaller as we leave the point of average height to either side. It is further known that the frequency of the records at each point of the scale is determined by

¹ From the *Revue scientifique*, October, 1885. By M. JACQUES BERTILLON.

the probability curve. The applicability of this curve to the representation of height has been frequently tested, and is found always to hold wherever the conditions upon which the law depends are present; viz., that variations in the phenomenon in question be due to a large number of causes, no one of which has any great effect. Where the law does not hold in the case of a series of heights, the probability is strong that there are some influences in question which cause a considerable variation in the average height. In several parts of France there is a strong indication of the existence of two types, distinguishable by their difference in height. If we draw the curve of height for these portions, this phenomenon is evident. A good example is shown in the department Doubs. The top of the curve for this region is M-shaped, while, in dealing with a case in which the probability case does hold,—that is, when a single type is present, as in La Creuze,—the top of the curve resembles an inverted V. There exist, then, in all the provinces in the north-eastern half of France, two types which can actually be separated from each other. This is shown on the map by the occurrence of pairs of smaller circles; and the ratio of the size of these circles indicates the proportion of the two types in each part. The average height of the tall type is 5 feet 6.6 inches; of the other, 5 feet 4.6 inches. It is certainly a curious fact that these two peoples, who now have every thing in common,—language, mode of life, and all,—who intermarry freely, and probably have no consciousness of their dual origin, should still be unidentified by the constant characteristic of a difference in height.

It is probable that other circumstances than those of race can affect the stature of a people. Chief among these are, 1°, the well-being of the community; and, 2°, pathological conditions. There are countries where the average stature has changed without the introduction of a new racial element. In the low countries (Holland, etc.) this phenomenon is ascribed to the effect of the draining of the marshes, and the general betterment of the people.

The statistics of Saxony, from 1852 to 1854, make possible a comparison between the heights of the liberal and the laboring professions. If we draw the curves representing the number of each class at each height, the curve for the liberal professions shows a superiority of height throughout. They have fewer short persons, and more tall ones. The difference between the two, however (5 feet 5.6 inches and 5 feet 4.25 inches), is smaller than in the case of racial difference.

A case in which pathological influences (such as

cretinism) seem to be active is offered in Switzerland. Here there seems to exist a true type of dwarfs whose heights centre about 4 feet. The suggestion that minor influences such as these may also be active in producing the differentiation of height in France, is worthy of consideration.

THE EXTRACTION OF SUGAR FROM SORGHUM AND SUGAR-CANE.

THE experiments in the application of diffusion and carbonatation to the extraction and crystallization of sugar from sorghum, which have been in progress under the direction of Dr. H. W. Wiley and his assistants at Ottawa, Kansas, during September and October, have been described by him in Bulletin No. 6 of the chemical division of the department of agriculture. The difficulties met with were largely of a mechanical nature, or resulting from the effects of early frost injuring the quality of the cane which was used for the experiment.

Of the trial on Oct. 8, Dr. Wiley says that during a run of about 21 hours, 70 cells, of about 1400 pounds of cane apiece, or 49 tons, were diffused, giving from 65 cells 96,140 pounds of juice. The exhausted chips contained less than 2 per cent of sugars, and the waste waters about the same amount; so that the extraction may be said to be nearly complete. The cost was about 80 cents per ton, and, with improvements in the mechanical details of the apparatus, labor and fuel can be saved, and the cost reduced to 30 cents. The juice drawn off stood to the cane chips in the ratio of 110 : 100 in the first, and 95.3 : 100 in the second, part of the experiments. The solids it contained varied from an average of 1.024 per cent, corresponding to a specific gravity of 1.0394 at 25° C., in the first half, to 10.55, corresponding to 1.0405 at 25° C., in the second half, of the experiment.

The juice corresponding to 15 tons of cane was defecated by the method of carbonatation, and yielded 4320 pounds of *masse cuite*, containing 77 per cent of solids, or a little more than 14 per cent of this cane worked. This, on being 'swung out,' yielded 1420 pounds, or 30 per cent of sugar well washed and dried, polarizing about 98 per cent, or at the rate of 95 pounds to the ton. The yield of second sugars would, of course, increase the rate of production per ton. Allowing 12 pounds to the gallon for the *masse cuite*, the number of gallons per ton would be 24, which is far in excess of the amount usually produced.

Dr. Wiley's general conclusions are as follows:—

1. By the process of diffusion 98 per cent of the sugar in the cane was extracted, and the yield was

fully double that obtained in the ordinary way. 2. The difficulties to be overcome in the application of diffusion are wholly mechanical. 3. The process of carbonation for the purification of the juice is the only method which will give a limpid juice with a minimum of waste, and maximum of purity. 4. By a proper combination of diffusion and carbonation, the experiments have demonstrated that fully 95 per cent of the sugars in the cane can be placed on the market either as dry sugar or molasses.

PROGRESS IN METALLURGY.

ONE of the serious metallurgical problems of today is the recovery of the by-products from the manufacture of coke by the destructive distillation of bituminous coal. In this country coke for metallurgical purposes is prepared almost exclusively either in open heaps or in 'beehive' ovens, — hemispherical fire-brick chambers into which sufficient air is admitted to burn the distillates, and thus to produce the heat required for the distillation itself. Not only are the distillates, which contain ammonia and tar, of great value to the color-maker, thus wasted, but, as they burn in actual contact with the coking mass, much (often twenty-five per cent) of the coke itself is incidentally burned. Both these evils are completely avoided by coking in retort ovens, heated externally by the combustion of the distillates, but after they have deposited their tar and ammonia in surface condensers. The first volume of the *Journal of the Iron and steel institute*, for 1885, contains an important group of papers and discussions on this subject, whose net result is to place the advocates of retort coking in a much stronger position.

The iron blast-furnace is the chief consumer of coke; and though in continental European blast-furnaces (and in British foundry cupolas as well) retort coke is as efficient as beehive coke, and though the calorific powers of the two fuels are almost identical, yet in British and American blast-furnaces the efficiency of retort coke has hitherto proved so low as to largely offset the advantages of the retort, — its greater yield of coke and its recovery of by-products. Hence the retort has gained but a slight foothold in these countries, though used on the continent very extensively and successfully with coals of widely varying compositions and properties. We may solve the retort problem either by adapting our retorts to the requirements of our coal, or by adapting our blast-furnaces to the requirements of retort coke.

Mr. J. Lowthian Bell shows by conclusive ex-

periments that the low efficiency of British retort coke is due to its ready solubility in the carbonic acid which it encounters on entering the blast-furnace; and this, in turn, appears to be mainly due to the comparatively low temperature of retort coking. It would seem practicable, however, to raise this temperature approximately to that of the beehive; and Mr. H. Simon and Mr. Watson Smith describe the adaptation of the Siemens regenerative system to the retort for this purpose, and the improvement in the quality of the tar which it has effected. The problem of adapting the retort to the coal seems thus in a fair way to solution, while that of adapting the blast-furnace to retort coke appears to be in an equally promising condition, if we may judge from comparative tests which Samuelson describes, conducted on a gigantic scale in his blast-furnaces, themselves highly efficient, in which British retort coke shows an efficiency equal to that of the best beehive coke. This one success outweighs in importance fifty previous failures.

A very important contribution to the world's supply of tar and ammonia is promised from another source. A large and constantly increasing proportion of our metallurgical furnaces are heated by gas produced by the simultaneous distillation and partial combustion of bituminous coal and similar substances. In the apparatus employed the hydrocarbons, etc., arising from distillation, incidentally become diluted with such enormous volumes of nitrogen and carbonic oxide from the partial combustion of the coal, that the condensation of their tar and ammonia would require apparatus of a size and cost which are simply prohibitory; and, unable to separate these valuable substances, we burn them in enormous quantities. But Mr. John Head describes an egg of Columbus which promises to enable us to isolate the distillates for condensation and the manufacture of illuminating-gas.

A knowledge of the relations between the chemical composition and the physical properties of iron, which would enable us to infer the latter from the former, would be invaluable: unfortunately investigation has thus far only plunged these relations into hopeless confusion. To elucidate the subject, Dr. Hermann Wedding has carried out extensive and ingenious microscopic studies of the structure of iron. We have not space to analyze the results which he here presents, further than to give as a sample his announcement that malleable iron, produced by any fusion process, consists of two distinct components: 1°, minute porphyritically distributed crystalline particles; and, 2°, a homogeneous matrix in which they are distributed.

RECENT CHALLENGER MONOGRAPHS.

FOUR great books of final reports of the Challenger expedition, together with two volumes of 'the narrative,' represent the outcome of the last few months of work of the Challenger staff. Commendation seems superfluous in describing a work so monumental in its character; but, on the other hand, it is impracticable to speak of it, either as a whole or in any one of its subdivisions, without the most enthusiastic praise.

Professor Turner of Edinburgh discusses the human crania in a paper of 130 pages (part xxix. vol. x.), which is one of the most important contributions to somatology ever printed in English. The last sixteen pages are devoted to general conclusions, drawn, not only from the study of the crania gathered by the Challenger in southern Africa and America, Australia and the Pacific Islands, but of those in the Edinburgh university museum and several other collections. The paper is, in fact, an essay upon the craniology of certain races, — the Bushmen, Fuegians and Patagonians, Australians, New Zealanders, and the Admiralty, Chatham, and Sandwich Islanders. A short paper, on the other human bones is to follow. The body of the memoir is densely packed with details of craniometry, for the most part in tabular form, and critical notices of past investigations. The 29 illustrations are exceedingly satisfactory, especially the diagrams of sections of skulls drawn by the author.

One of the most noteworthy results of this investigation is that it has given Professor Turner still stronger convictions upon the importance of craniology as the foundation of a classification of the races of mankind. Without undervaluing the classific value of such features as the color of the skin, the color and character of the hair and eyes, the shape of the nose and lips, the stature and the form of the pelvis, he maintains, that, by taking a combination of craniological characters, there may be laid down certain propositions as regards *unmixed* races of men, which, while allowing for the occurrence of occasional individual variations, will be as distinctive as those afforded by the study of any other series of physical characters.

In unmixed races, where the skull is markedly dolichocephalic, brachycephalic skulls never occur; and similarly in unmixed races, where the skull is markedly brachycephalic, dolichocephalic skulls are not met with. People resulting from mixtures, especially of dolicho- with brachy-cephalic races, are more difficult to deal with; for some will have heads which exhibit, with little variation, the characters of one or other of the two parent types,

while in others intermediate characters will arise which incline toward those of one or other of the ancestral types. It is, he thinks, through lack of recognition of the true effects of mixture of races that discredit has been thrown on the value of the skull in the determination of racial characters.

The author, while inclining to the belief that, as a rule, unmixed races are either long or short headed, and that mesaticephalic peoples usually proceed from mixtures, admits that certain of the mesaticephali — for instance, the Tasmanians, and the Bush race of South Africa (not improbably the remains of the primitive people of Africa) — may be classed with the unmixed races.

The discussions of the extent and character of individual variation within the limits of a race are to be of a very scholarly and suggestive character.

The author advances the idea that the races of the extreme south, Bushmen, Fuegians, Australians, Tasmanians, and Negritos, with their feeble frames, small heads, low statures, and low intellectual development, may in the early unwritten periods of history have had in their respective continents a much wider range than at present, and have been pushed southward into their present restricted areas by the advance of the more powerful races which now surround them. If in their displacement they failed to mix with their invaders, their physical characters would remain pure, for isolation and long-continued interbreeding would preserve and even intensify the structural peculiarities of each race.

The enigma concerning the builders of the megalithic monuments on Ascension and Easter Islands, the Fijis, the Gilbert Islands, and Tongatabu, is simply restated, — the natives can neither account for them by tradition, or show physical evidence that their forefathers could have created such structures, nor are there any traces of races, pre-existing in the Pacific region, capable of such enterprises.

The study of the Patagonian and Fuegian skulls suggests interesting speculations as to the origin of the peoples of South America.

It is rather mortifying to find that our own countrymen have accomplished so little in the field of craniology, that in this exhaustive treatise there occurs but a single incidental allusion to any American authority.

Dr. Rudolph Bergh of Copenhagen, in an essay of 151 pages, with 311 figures of structural details beautifully drawn by himself (part xxvi. vol. x.), treats of the Nudibranchiata. The paper is purely descriptive and critical, and deals chiefly with the 25 forms collected by the expedition, which include 11 new species and 3 new genera. He gives, however, a list of all known forms in each genus

which comes up for discussion, the number sometimes being very large, as in *Chromodoris* with its 95 species. The remarkable new genus *Bathydoris*, dredged in mid-Pacific at depths of 14,550 feet, is described at great length, and elaborately figured.

The family *Onchidiadae*—‘modified shell-less pulmonates,’ resembling in form certain nudibranchiates—are treated of in an appendix, with historical and critical notes. Bergh believes that the tropical seas, though hitherto but slightly explored for nudibranchiates, will ultimately prove to be the headquarters of this group. The absence of allusions to American work emphasizes the fact, already pretty well appreciated on this side of the Atlantic, that in the study of this group there is an excellent opportunity for some one of our young naturalists who has not yet chosen a specialty.

The venerable George Busk prints part i. of his report upon the *Polyzoa* (part xxx. vol. x.), which treats of the *Cheilostomata*, enumerating 286 species from the Challenger's work, of which 180 are described as new. The workmanship of the paper is in the author's own peculiar style of excellence. There are nearly a thousand figures, and the pages devoted to an explanation of terms used in description are especially acceptable. The general conclusions arrived at by Mr. Busk are evidently withheld for the second part of his report. The geographical and bathymetrical distributions of the group are treated at great length, and illustrated by an instructive map. Four species of *Polyzoa* were taken by the Challenger in the North Pacific at the depth of 3,125 fathoms; and one of these, *Cribrilina monoceras*, was taken in the Australian region at a depth of 35 fathoms,—an instance of extensive range in depth unparalleled elsewhere.

Dr. Hoek's report upon the *Cirripedia* (part xxv. vol. viii.; part xxviii. vol. ix.), although the author mourns that his studies upon the deep-sea material have not yielded results equal to his own anticipations, is a very important contribution to zoölogy. It is printed in two parts, and is brimful of concisely stated observations and pregnant criticisms. It is an excellent example of the scholarly work which the naturalists of the Netherlands have of late been producing, and is no unworthy continuation of the classic memoir upon the same subject published a third of a century ago by Darwin. The systematic portion of the reports is devoted entirely to the description of the Challenger's collection, but in the introduction is given a critical review of all that has been discovered or written concerning the group since the time of Darwin, and also a new zoögeographical arrangement of all known species.

One of the most surprising of the recent reports is that by Dr. von Graff upon the *Myzostomida* of the expedition. Fifty-two of the 68 species discussed appear here for the first time. In fact, all the known species of the group have been brought to light by Dr. von Graff, with the exception of three described by Leuckart, by whom the genus *Myzostoma* was first discovered. These very remarkable animals, by Dr. von Graff placed among the arachnids, by other authorities among the worms, near *Tomopteris*, and only found parasitic upon and in crinoids, are being found in all the zoölogical collections, now that attention has at last been directed to their very inconspicuous existence. Twenty-two species, 14 of them new, are attributed to the explorations of the U.S. steamers *Bibb*, *Hassler*, *Blake*, and *Corwin*. A concise account of what is known concerning the *Myzostomida* serves as a preface, and there is a curious colored diagrammatic figure printed in with the text. The lithographic plates are exquisite.

In a second paper upon the *Entomostraca* (part xxiii. vol. viii.), Dr. G. Stewardson Brady treats of the *Copepoda*. His paper is mainly descriptive, and is, of course, prepared in his usual scholarly manner. There are 55 plates, diagrammatic and useful, but not artistic; and 142 pages of text, treating of 90 free-swimming species, and 15 fish parasites obtained by the Challenger, only one of which, *Pontostratiotes abyssicola*, dredged in a depth of 2,200 fathoms, is undoubtedly a deep-sea species.

The report upon the calcareous sponges, by Professor Poléjaeff of Odessa, a pupil of Schulze's, enumerates 30 species, 23 of which are new. A considerable portion of the paper is devoted to destructive criticism of the previous work of Professor Haeckel, and the construction of a new ‘natural classification’ of the group. There are four superb plates of white sponges upon black backgrounds, as well as a number of anatomical figures beautifully drawn by the author.

Mr. Henry B. Brady's ponderous memoir on the *Foraminifera*, in two volumes,—one of text, 814 pages; and one of illustrations, 115 plates and at least 2,000 figures,—is really a monographic revision of the entire group, with an exhaustive bibliography, from the year 1565 to the present time, and a chapter on classification, historical, critical, and constructive, leading up to an elaborate synopsis of families and genera. The synonymies and the tables of geographical distribution are made up in a very workmanlike manner, and the index is a delight to weary eyes.

The animals of this group are distributed everywhere over the ocean-bottom, as well as at the surface and in mid-waters. The presence or ab-

sence of the calcareous shells of some of the pelagic species at different depths and in different localities is connected with some of the most important problems in oceanography. It was of the greatest importance that all questions relating to geographical and bathymetrical distributions should be discussed with reference to a thorough understanding of the relations of all existing forms; and it was, indeed, a fortunate thing that a naturalist so familiar with the Foraminifera as Mr. Brady should have undertaken this work.

Mr. Brady, referring to certain views held by Dr. Wm. B. Carpenter and his colleagues concerning the existence or non-existence of true species amongst the lower Protozoa, which are, he admits, "from a purely biological stand-point, for the most part incontestable," holds that they really embody only one aspect of the subject. Although in some families, not merely reputed species, but reputed genera, are connected by a close array of intermediate modifications and dimorphous forms, and all sharp demarcations have ceased to exist, in others the successive modifications appear to be less closely connected, and to possess distinctive characters of greater persistence. "Admitting," he writes, "the intimate relationship which often prevails throughout an entire generic group, admitting even that all the members of a genus may be referred to a common ancestral type, the question still remains how the different terms of each series are to be recognized. The various modifications which have been referred to differ not merely in details of form and structure, but in habit. They are met with under diverse conditions as to latitude, depth of water, nature of sea-bottom, and the like, and their modes of life are often totally distinct; furthermore, fossil specimens, with similar peculiarities, appear to have existed under precisely corresponding circumstances. Whether 'species' or not, the more important of them possess characters which afford means of easy identification, and it is obviously necessary that they should be provided with distinctive names." He admits the value, as a method of study of the plan proposed by Parker and Jones, in their memoirs on North Atlantic Foraminifera, of grouping the almost endless varieties of the Foraminifera around a small number of typical and sub-typical species, but denies that this plan may be made a basis of nomenclature. The binomial system must be retained, and it is impossible to deal with the multifarious varieties in this group without a much freer use of distinctive names than is permissible among animals endowed with more stable characters.

The chapter on the chemical composition of the tests of the Foraminifera possesses considerable

interest in connection with the study of bottom deposits. That upon pelagic species would be much more satisfactory to the reader if rather more definite conclusions could have been attained by the author of the memoir in a manner satisfactory to himself.

Eozoon is admitted to a place in the synopsis, but Mr. Brady does not commit himself to any opinions. In the introduction to his bibliography, he states that many of the titles of the less important contributions to the Eozoon controversy are admitted. The American names in the bibliography are those of Isaac Lea, the earliest, 1833, S.G. Morton, J. W. Bailey, E. de Verneuil, J. Hall, Meek and Hayden, G. G. Shumard, W. M. Gabb, J. W. Dawson, Count Pourtales, J. P. Whiteaves, C. A. White, H. A. Johnson and B. W. Thomas, T. A. Conrad, Angelo Heilprin, and J. Leidy.

The publication of the results of the Challenger is evidently being forwarded as rapidly as the limitations of painstaking research will permit. It is much to be regretted that the French zoologists who have the work of the *Talisman* and *Travailleur* in charge do not profit more by this example.

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DROUGHT AND WEATHERCOCKS.

A WRITER in *Symons's meteorological journal* calls attention to a connection between drought and weathercocks. The connection does not always exist. Some weathercocks are entirely independent of drought or floods, and some are very seriously affected. The former are those which do not carry any of the usual letters N, E, S, W, or which are wholly of metal, and carried on metal or stone supports. The weathercocks which suffer from drought are those which have the cardinal points indicated by the letters, and which (though themselves of metal) are carried at the summit of a tall pole. The pole, under the influence of sun and drought, splits, and the cracks run nearly along its length, but not precisely. They are slightly inclined, and all run parallel. If the drought is prolonged, they become numerous, and, though no one crack may be a tenth of an inch, the aggregate amount becomes large. We have ourselves measured one on which the letters were, during the July drought, carried round 44°; the S letter was carried around until it pointed almost exactly S.W. With subsequent moisture the cracks have partly closed, and possibly by November the letter S will be nearly back in its true position; but as to this we have no knowledge. It is evidently necessary for observers to watch for the occurrence of this somewhat strange error.



THREE NEW PORTRAITS OF WASHINGTON.

SCIENCE, December 11, 1885.